

Section 5

Source Water Protection

This section of the 2001 Water System Plan (WSP) describes Seattle Public Utility's (SPU) programs for protecting water quality at the source.

Source watershed ownership protects water quality from possible contamination through control of access and activities within the watersheds. The City of Seattle has a goal of full public (City and U.S. Forest Service) ownership of the watersheds that provide water to the City and regional purveyors.

The City also utilizes the Highline Wells, a ground water source, as an intermittent peak demand and emergency water supply. The City has pursued pollution prevention activities concurrent with the development of the wells, and has developed a Wellhead Protection Program (WHPP).

For all water supply sources – the Cedar River, the South Fork Tolt River, and the Highline Wells - the City emphasizes source protection as a key element of its operations.

5.1 Watershed Control Program for Cedar and Tolt Sources

Within SPU, the Watershed Management Division (WMD) is charged with maintaining the integrity of raw water supplies in the Cedar River and South Fork Tolt watersheds through enforcement of State and federally mandated regulations. WMD staff work closely with Water Quality and Supply Division and Water Operations Division staffs to provide integrated management of the watersheds. The WMD's Watershed Protection Section has primary responsibility for protection of the City's municipal watersheds.

5.1.1 Cedar River Watershed Protection Program

The City has expended significant resources to maximize the ownership of the Cedar River Watershed, in order to best protect and manage source water quality. This is especially critical since the Cedar River will remain an unfiltered surface water supply for the foreseeable future. It is the City's philosophy that protecting the source water in order to eliminate or minimize degradation rather than having to treat a lesser quality source is the most responsible course of action. In the future, ozonation facilities at Lake Youngs will further improve water quality, but the role of source water protection as a public health protection barrier will remain a critical element in the Cedar River watershed.

Cedar River Watershed Description and Characteristics. The Cedar River Watershed is a 90,546-acre area located on the west slope of the Cascade Mountain Range approximately 30 miles southeast of Seattle (Exhibit 3-1 and Appendix 5-A). The watershed extends eastward 24 miles from the Landsburg Diversion to include the headwaters of the Cedar River near Yakima Pass at the Cascade Crest. Elevation gain in the watershed is 4,871 feet from the Landsburg Diversion to the 5,414-foot summit of Meadow Mountain on the eastern boundary.

The Cedar River Watershed Protection Program (SPU, 1999b) provides a detailed description of the watershed and its hydrology, vegetation, and wildlife and fisheries resources. Section 3 of this WSP describes the facilities in the Cedar River system.

SPU is the City's agency responsible for control of all activities in the Cedar River Watershed.

Activities and/or Land Uses within the Cedar River Watershed. SPU is the City's agency responsible for control of all activities in the Cedar River Watershed that have the potential to adversely affect water quality. Access is closed to public use and restricted to activities authorized by SPU. Washington State Department of Health (DOH) identifies 15 activities or land uses recognized as having the potential to adversely affect water quality if they occur in municipal watersheds. Of those, eight are present in the Cedar River Watershed:

- Septic systems at Cedar Falls Headquarters complex and at Landsburg;
- Road construction repair and maintenance and fire prevention/control;
- Recreation at Rattlesnake Lake and Landsburg Park;
- The existence of fish and wildlife populations;
- Transportation route (Kerriston Road);
- The Cedar Falls hydroelectric generation facility;
- Flood control activities; and,
- Research and education.

Several of these activities occur on SPU lands, but outside the hydrological boundary of the watershed. More detail on these land uses or activities, and associated monitoring to assess the impacts are presented in the revised Watershed Protection Plan submitted to DOH in October 1999.

Cedar River Watershed Control Measures. The control measure descriptions are organized in the context of addressing the activities identified above as “potentially” having adverse impacts on water quality. The effectiveness of each control program is assessed annually during the Annual Inspection and the Surface Water Treatment Rule (SWTR) Annual Report document submitted to DOH.

The Cedar River Watershed is virtually 100% owned by Seattle and is a highly protected resource.

Land Ownership and Written Agreements - The City of Seattle owns virtually 100% of the Cedar River Municipal Watershed. Seattle is currently in discussions with Burlington Northern Railroad regarding ownership of approximately 30 acres of the right-of-way along a recently abandoned rail line.

Land Use Restrictions - On City owned watershed land SPU has the authority to implement land use restrictions. SPU currently restricts use predominantly through the enforcement of Road Use Permit programs and Watershed Access and Quality Control Regulations. Watershed boundaries are posted and/or fenced; and access gates are locked and posted. Watershed Protection Section personnel work cooperatively with King County Law Enforcement personnel to address illegal or unauthorized activities in the watershed.

Timber Harvest and Construction - In accordance with the recently adopted Cedar River Watershed Habitat Conservation Plan (HCP), no timber harvesting activities will occur in the Cedar River Watershed in the future.

Based on the recently adopted HCP, no timber harvesting activities will occur in the Cedar River Watershed in the future.

Construction activities within the watershed support watershed protection and surveillance activities. These activities consist of road, culvert, and bridge improvements or replacements, and road abandonment. This work has been found to protect water quality by reducing the loading of sediments and organic materials into feeder streams. The abandonment of poorly constructed or less used roads allows for better and more frequent maintenance of remaining roads.

Inspections, Surveillance, and Monitoring - WMD Watershed Inspectors are responsible for watershed protection, surveillance, water quality monitoring, and compliance with source water related drinking water regulations. The specific duties of the Watershed Inspectors can be found in the Watershed Protection Plan. They generally consist of:

- Daily enforcement of access and sanitation regulations;
- Water quality inspections to provide early warning of possible water quality degradation;
- Emergency response;
- Field sample collection and analysis; and

- Routine inspection of watershed trails, roads, gates and fence lines for damage or signs of trespass.

Contaminant Source Assessment - In 1995, SPU submitted the Surface Water Checklist for the Cedar River source (SPU, 1995b). The checklist was used to assess contamination vulnerability, predominantly for chemical contamination. It also provided information about overall source protection/management programs. Seattle's Cedar River Source was rated as having a "LOW" vulnerability to contamination.

The Cedar River Watershed is closed to unsupervised public access.

Public Education - The Cedar River Watershed is closed to unsupervised public access, however, SPU conducts an active public education and information program that utilizes watershed visitation. The program is designed to inform the public of the function and importance of the watershed, the need to protect it, and the responsibility SPU has as a steward of a natural and cultural resource. Most public interest (and program emphasis) is on the Cedar River Watershed, predominantly because of its larger size and rich history of human use.

Approximately 10,000 people per year visit the Cedar River watershed on supervised tours. Eighty percent of the visitors are in school groups; the other 20 percent of visitors are adult special interest groups, groups of professionals, agency representatives, and groups from the general public.

A new visitor's center is planned at Rattlesnake Lake to promote understanding of the Cedar River Watershed and the SPU system.

New facilities have been or are being constructed on the Cedar River system to enhance SPU's ability to share information with the public without increasing the potential for impact to the source water. These include a new visitor education center at Rattlesnake Lake, currently under construction and expected to be complete in 2001. Rattlesnake Lake is within the administrative boundaries of the watershed, but it is outside the hydrological boundary of the Cedar River.

Cedar River Watershed Monitoring. Water quality monitoring is conducted throughout the watershed for database development, regulatory compliance, and to a lesser extent, academic research. Monitoring occurs in the watershed at numerous locations, and continues down to the Landsburg Diversion. Water quality at the water supply system intake is monitored to demonstrate compliance with raw water quality criteria required of unfiltered supplies. Collected data provides information needed to anticipate changes in water quality which may necessitate treatment adjustments or system operational changes. Monitoring is designed to track trends in water quality and short-term changes related to storm events. More details about specific monitoring programs can be found in the Cedar River Watershed Protection Plan.

5.1.2 South Fork Tolt River Watershed Protection Program

The South Fork Tolt Watershed contains 13,390 acres (Exhibit 3-2 and Appendix 5-B). Seattle's land ownership in the South Fork Tolt River Watershed is not as extensive as in the Cedar River Watershed. However, ownership in the South Fork Tolt watershed more than doubled in the last several years from 29% in 1994 to 69% in 1999. The remaining 31% is under U.S. Forest Service ownership, and is located in the eastern end of the watershed. Access to this area is difficult, and activities there are unlikely to significantly affect water quality.

Even with the planned Tolt treatment facility, SPU will continue to implement comprehensive watershed controls.

The South Fork Tolt River watershed has been subjected to human impact more than the Cedar River watershed. Because of the higher level of impact and fewer acres under SPU's control, SPU has focused land acquisition efforts on lands that have the greatest potential for protecting water quality. A new direct filtration treatment plant with ozonation is currently under construction and will be brought on line in late 2000. Although the new treatment will improve water quality, SPU will continue to implement comprehensive watershed control measures.

The potential for impacts to water quality at the Tolt River Watershed by activities of USFS are minimal to none at all. The USFS lands adjacent to watershed lands are in Successional Reserve; meaning there are no plans to log; the forest would be left to grow into an old growth forest. The road from the watershed to USFS land has recently been closed. There are no plans for any chemical uses on these lands, fire suppression would be with water helicopter.

South Fork Tolt River Watershed Description and Characteristics.

The 13,390-acre South Fork Tolt Watershed is located in northeastern King County, approximately 35 miles east of Seattle, near the town of Carnation. Elevation gain in the watershed is 4,566 feet from the regulating basin (765 feet) to the peak of Read Mountain at 5,331 feet. The South Fork Tolt River is a tributary of the Snoqualmie River system, entering the Snoqualmie River near Carnation.

The Tolt Watershed Control Program (SPU, 1999c) provides a more detailed description of the watershed and its hydrological and vegetation characteristics and wildlife and fisheries resources. Section 3 of this WSP describes the facilities in the Tolt River System.

Activities and/or Land Uses within the South Fork Tolt River Watershed. Several activities or land uses are recognized as having the potential to adversely affect water quality if they occur in municipal watersheds. Of the 15 potential adverse activities or land uses identified by DOH as needing evaluation, 5 are present in the South Fork Tolt River Watershed:

- Septic systems at the existing Tolt Treatment Plant and Vista House;
- Road construction repair and maintenance and fire prevention/control;
- The existence of fish and wildlife populations;
- The Tolt hydroelectric generation facility; and,
- Flood control activities.

More detail on these land uses or activities, and associated monitoring to assess the impacts are discussed in greater detail in the revised Watershed Protection Plan submitted to DOH in October 1999.

South Fork Tolt River Watershed Management and Control Measures. The SPU WMD is charged with maintaining the integrity of the Tolt raw water supply. Various control measures are used to minimize and reduce possible detrimental impacts on water quality. The effectiveness of these control measures is assessed annually during the Annual Inspection, or in the SWTR Annual Report document submitted to the DOH.

Seattle owns 69% of the South Fork Tolt River Watershed.

Land Ownership and Written Agreements - The City of Seattle owns 69 percent of the South Fork Tolt River Watershed. The U.S. Forest Service (USFS) is the other landowner (31 percent) in the South Fork Tolt watershed. SPU exercises control of activities on non-SPU land to the best of its ability through coordination with USFS. Although, SPU has not secured specific agreements with the USFS, the Mt. Baker-Snoqualmie National Forest Management Plan requires the USFS to "manage its lands

to provide water at a level of quality and quantity, which, with treatment by the purveyor, will result in satisfactory and safe water supply with varying emphasis on timber production, recreation, and other uses." Access to USFS lands is only possible on foot, from the east end of the watershed, so public access is limited.

Land Use Restrictions - Seattle has the ability to implement land use restrictions either as the property owner, or through the agreement with the Weyerhaeuser Company. As in the Cedar River watershed, SPU uses a Road Use Permit program and Watershed Access and Quality Control Regulations to control activity.

Timber Harvest - Timber harvest within the South Fork Tolt watershed has occurred for over 50 years and has been the most historically significant secondary use of the watershed.

The USFS has no plans for timber harvest in the near future.

The USFS has no plans for harvest in the near future. Most of the USFS land in the watershed is currently identified as "reserve status" to protect wildlife dependent on old-growth forests. None of the timber owned by SPU is near merchantable age, and SPU has no plans for timber harvesting in the near future.

Inspections, Surveillance, and Monitoring - The Watershed Protection Section of the Watershed Management Division is responsible for watershed protection, surveillance, water quality monitoring, and compliance with source water related drinking water regulations. Staff in the WMD work closely with staff of the Water Quality and Supply Division and in the Water Operations Division to provide integrated management of both water supply sources. The specific duties of the Watershed Inspectors are the same as those in the Cedar River watershed. A more detailed description of duties is available in the Watershed Protection Plan.

Contaminant Source Assessment - In 1995, SPU submitted the Surface Water Checklist for the South Fork Tolt River source (SPU, 1995c). The checklist was used to assess contamination vulnerability predominantly from chemical contamination. The South Fork Tolt River was rated as having a "LOW" vulnerability to contamination.

Public Education – The majority of Public Education and Information programs conducted by SPU are focused on the Cedar River Watershed. This is expected to be modified somewhat in the future as interest in the new treatment facility shifts some attention to the South Fork Tolt watershed.

South Fork Tolt River Watershed Monitoring. Water quality monitoring is conducted throughout the watershed regulatory compliance, database development, and to a lesser extent, academic research. Monitoring occurs in the watershed at numerous locations, and continues down to the intake at the Regulating Basin. All collected data provides information needed to anticipate changes in water quality which may necessitate treatment adjustments or system operational changes. Monitoring is designed to track trends in water quality and short-term changes related to storm events. More details about specific monitoring programs can be found in the South Fork Tolt Watershed Protection Plan.

5.2 Highline Wellhead Protection Program (WHPP)

The Highline Wells are protected with a Wellhead Protection Program.

The Highline Wellhead Protection program manages the area surrounding the three SPU production wells with the intent of preventing potential contamination of the ground water which supplies the wells. The objective of the WHPP is to protect the Highline Wellfield, and its source aquifer, from contamination so as to assure its preservation as a municipal drinking water supply. This is done by providing management zones around the wells to detect and manage potential sources of ground water contamination. Wellhead protection is proactive and emphasizes pollution prevention by agency coordination among multiple levels of government to protect public drinking water supplies.

5.2.1 Development of the Highline Wellfield

During the 1980s, Seattle Water Department, since incorporated into Seattle Public Utilities (SPU), developed and put in service a groundwater source known as the Highline Wellfield. The Wellfield consists of three production wells capable of delivering a total of ten million gallons per day (MGD). The Wellfield has two basic uses: (1) A peaking source that could be started on or about July 1st each year and run for up to four months; and (2) An emergency supply as, for example, its use following the Cedar River flooding of November 1990. In the early 1990s, artificial recharge as a means to enhance Wellfield productivity was studied under a grant from the U.S. Bureau of Reclamation. Artificial recharge of the aquifer with treated drinking water from SPU's Cedar River source was found to be feasible, and is a component in operational guidelines for use of the Wellfield. SPU operators favor the use of the Cedar and South Fork Tolt surface water sources for reasons of economy and ease of operation, so the Highline Wellfield does not experience heavy use. Additionally, SPU Water managers consider it prudent to keep the aquifer storage in reserve in case of emergency. To date, the maximum withdrawal from the wellfield occurred in Water Year 1988 when total pumpage was 1.1 billion gallons.

5.2.2 Federal and State Mandates for Wellhead Protection

The 1986 amendments to the Federal Safe Drinking Water Act require that all states establish a Wellhead Protection Program (WHPP). Washington's program, adopted in July 1994, is administered by DOH. Under the state program, SPU is required to develop and implement a WHPP for the Highline Wellfield. By prior arrangement with DOH, the WHPP is to be submitted as part of SPU's updated water system plan.

5.2.3 Plan Development

In undertaking development of the Highline Wellfield, SPU recognized early the need to look closely at potential contamination threats to the Wellfield's source water. All SWD's prior experience had been with surface water sources in highly controlled watersheds. In contrast to surface sources, the Wellfield is located in an area, outside of Seattle land use authority, that has experienced a wide range of uses over an extended period of time. Therefore, the preliminary investigations included a survey of potential contamination sources, a network of monitoring wells was constructed, and a program of periodic aquifer monitoring was incorporated into the Wellfield operation plan.

To some extent, the proposed WHPP has built on the original studies that were performed in the early phases of the Wellfield's development. However, the WHPP is structured to address all elements required by the DOH guidelines. The WHPP provides a framework for documenting administrative processes and procedures, and for presenting the summary results of the technical studies that shaped the WHPP. SPU staff have prepared the WHPP, with technical support from the same consultant team that assisted SPU in the development of the Wellfield. Preparation of the plan required contacts with, and assistance from, the staffs of several agencies:

- Department of Health
- Fire District No. 11
- Department of Ecology Northwest Regional Office
- Seattle-King County Department of Public Health
- King County
- City of SeaTac
- City of SeaTac Fire Department
- Port of Seattle

The Highline Water District is the other major user of groundwater in the immediate vicinity. The coordination with local agencies done by Highline Water District staff on the district's wellhead protection plan

preceded this effort. The district staff generously provided contacts as well as copies of documents that had been prepared.

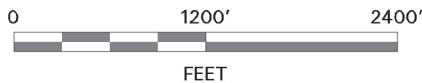
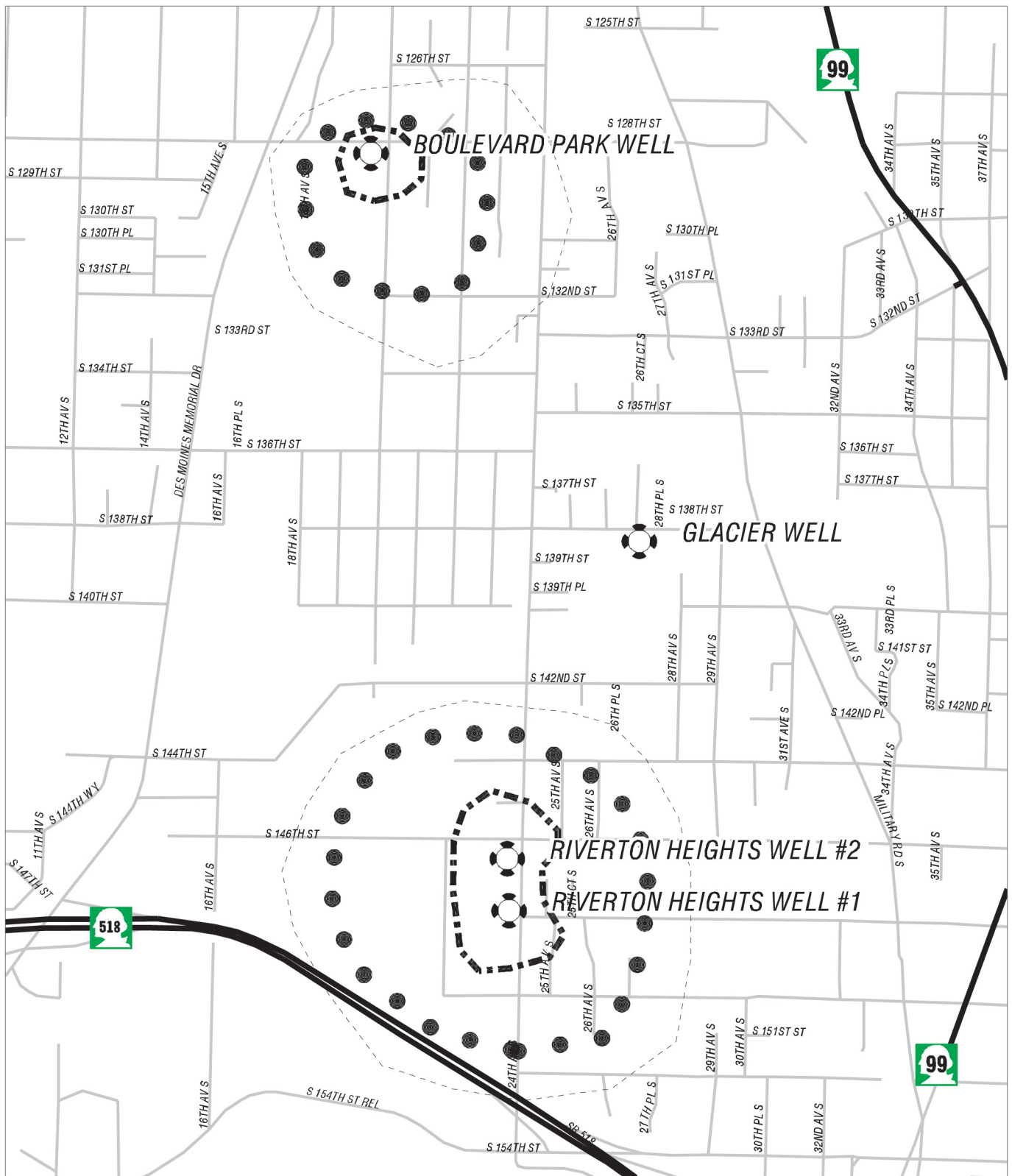
5.2.4 WHPP Elements and Organization

The WHPP is organized into the following elements, as prescribed in the DOH guidelines:

DOH rated the Highline Wells as having a “Low” susceptibility rating.

Assessment of Susceptibility. Drinking water supplies vary in their susceptibility to contaminants introduced at the surface. Factors that influence a well’s vulnerability are its construction and the geologic setting of the source aquifer. DOH uses the information submitted on the Susceptibility Assessment Form to rate a well’s susceptibility: high, moderate, or low. The well’s degree of susceptibility is then used to determine a monitoring program appropriate to the threat. DOH rated the Highline Wells as having a “low” susceptibility, which is documented in the WHPP.

Determination of Wellhead Protection Areas. A wellhead protection area is the surface and subsurface area surrounding the well through which a contaminant would pass as it is drawn toward the well. The type of delineation method is determined by DOH based on the number of service connections. The more connections a water purveyor has, the more sophisticated the method to delineate the protection area. SPU is in the highest category in terms of connections and sophistication of method as well, using the numerical flow method. Exhibit 5-1 shows the wellhead protection area delineated for the Highline Wellfield.



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 Coordinate System:
 State Plane, NAD83-91, Washington North Zone
 Vertical Datum:
 North American Vertical Datum of 1988 (NAVD88)
 Date of Photography: July, 1999



/customdev/theme/utilities/spu/well/well_both.html

EXHIBIT 5-1: HIGHLINE WELLFIELD



Seattle Well Site

Ground Water Contaminant Travel Times by Year



1 Year



5 Years



10 Years

*Seattle
coordinates with
several agencies
that would
respond to an
emergency which
could
contaminate the
wells.*

Inventory of Potential Sources of Ground Water Contamination. An inventory of potential contaminant sources is a key element of the WHPP. Its purpose is to identify past, present, and proposed activities that might threaten the aquifer. The initial inventory for the Highline Wellfield was performed even before the first production well was constructed, and was last updated in 1999. The inventory includes all potential sources of contamination within Zone 1 (1-year time of travel zone), and Zones 2 and 3 (5- and 10- year time-of-travel zones). The inventory is updated every two years.

Spill/Incident Response Planning. The agencies that would respond first in the event of a spill or related emergency in the vicinity of the Highline Wellfield are the local fire departments. SPU staff consulted with the two fire departments that have jurisdiction and documented their procedures for inclusion in the WHPP. SPU also coordinated with the Department of Ecology's Spill Response Team, the Department of Transportation, and King County Emergency Management. These agencies would also respond in the event of a spill or related emergency in the vicinity of the Highline Wellfield. Also presented in this section of the WHPP are SPU's internal procedures for dealing with an incident on its own properties within the wellhead protection areas.

Contingency Plan. The contingency plan outlines the actions that would be taken in the event that, despite our efforts, contamination caused the shutdown of one or more of the wells.

Wellhead Protection Area Management Plan. A number of federal, state, and local laws contain provisions that assist, directly or indirectly, in protecting the ground water resources in the vicinity of the Highline Wellfield. Local citizens in the area are vigilant and very alert to potential threats to the environment. Since the inception of the Wellfield project, SPU has conducted periodic sampling and testing for contaminants in a network of monitoring wells. The management plan is SPU's means to draw all the available protective measures to form an "umbrella" that will meet the WHPP objective.

Wellhead Protection Plan Responsibility. The Plan outlines responsibilities within SPU.